than new construction—makes up a large part of the work done by sheet metal workers. Installation of new air-conditioning and heating systems in existing buildings continues during construction slumps, as individuals and businesses seek more energy-efficient equipment to cut utility bills. In addition, a large proportion of sheet metal installation and maintenance is done indoors, so these workers usually lose less work time due to bad weather than other construction workers do.

Earnings

In 1998, median hourly earnings of sheet metal workers and duct installers employed in all industries were $13.48. The lowest 10 percent of all sheet metal workers and duct installers earned less than $7.96 and the highest 10 percent earned more than $24.97. Sheet metal workers who work in the construction industry generally have the highest earnings.

According to the limited information available, average hourly earnings—including benefits—for sheet metal workers who belonged to a union and worked full time ranged between $19.20 and $49.40 in 1998.

Apprentices normally start at about 40 percent of the rate paid to experienced workers. As apprentices acquire more skills of the trade throughout the course of the apprenticeship program, they receive periodic increases until their pay approaches that of experienced workers. In addition, union workers in some areas receive supplemental wages from the union when they are on layoff or shortened workweeks. Almost 40 percent of all sheet metal workers and duct installers are members of the Sheet Metal Workers' International Association.

Related Occupations

To fabricate and install sheet metal products, sheet metal workers and duct installers combine metalworking skills and knowledge of construction materials and techniques. Other occupations in which workers lay out and fabricate metal products include layout workers, machinists, metal fabricators, metal patternmakers, shipfitters, and tool and die makers. Construction occupations requiring similar skills and knowledge include heating, air-conditioning, and refrigeration technicians, and glaziers.

Sources of Additional Information

For more information about apprenticeships or other work opportunities, contact local sheet metal contractors or heating, refrigeration, and air-conditioning contractors; a local of the Sheet Metal Workers; a local of the Sheet Metal and Air Conditioning Contractors National Association; a local joint union-management apprenticeship committee; or the nearest office of your State employment service or apprenticeship agency.

For general information about sheet metal workers and duct installers, contact:

☛ The International Training Institute , 601 N. Fairfax St., Suite 240, Alexandria, VA 22314.

☛ The Sheet Metal and Air Conditioning Contractors National Association, 4201 Lafayette Center Dr., Chantilly, VA 20151-1209.

☛ The Sheet Metal Workers International Association, 1750 New York Ave. NW., Washington, DC 20006.

Structural and Reinforcing Metal Workers

(O*NET 87314, 87814, and 91714)

Significant Points

- Structural and reinforcing metal workers earn high pay but often can't work during inclement weather.
- These workers are among the most likely to be put out of work when downturns in the economy slow new construction.
- Most people enter this occupation through a formal 3-year apprenticeship.

Nature of the Work

Builders use materials made from iron, steel, aluminum, fiberglass, precast concrete, brass, and bronze to construct highways, bridges, office and other large buildings, and power transmission towers. These structures have frames made of steel columns, beams, and girders. In addition, reinforced concrete—concrete containing steel bars or wire fabric—is an important material in buildings, bridges, and other structures, as the steel gives the concrete additional strength. Moreover, metal stairways, catwalks, floor gratings, ladders, and window frames—as well as lampposts, railings, fences, and decorative ironwork—increase these structures functionality and attractiveness. Structural and reinforcing metal workers fabricate, assemble, and install these metal products. They also repair, renovate, and maintain older buildings and structures, such as steel mills, utility plants, automobile factories, highways, and bridges.

Before construction can begin, metal workers must erect steel frames and assemble the cranes and derricks that move structural steel, reinforcing bars, buckets of concrete, lumber, and other materials and equipment around the construction site. The structural metal arrives at the construction site in sections. There, it is lifted into position by a mobile crane. Metal workers then connect the sections and set the cables to do the hoisting.

Once this job has been completed, *structural metal workers* begin to connect steel columns, beams, and girders according to blueprints and instructions from supervisors and superintendents. Structural steel, reinforcing rods, and ornamental iron generally come to the construction site ready for erection—cut to the proper size, with holes drilled for bolts and numbered for assembly. Metal workers do this pre-construction site work in fabricating shops usually located away from the construction site. In these fabrication shops, metal workers lay out the raw steel received from a steel mill and cut, bend, drill, bolt, and weld each piece according to the specifications for that particular job. Metal workers at the construction site unload and stack the fabricated steel so it can be hoisted easily when needed.

To hoist the steel, metal workers attach cables from a crane or derrick. One worker directs the hoist operator with hand signals. Another worker holds a rope (tag line) attached to the steel to prevent it from swinging. The crane or derrick hoists steel into place in the framework where several workers, using spud wrenches, position the steel with connecting bars and jacks. Workers using drift pins or the handle of a spud wrench—a long wrench with a pointed handle—align the holes in the steel with the holes in the framework. Then they temporarily bolt the piece in place; check vertical and

Reinforcing workers wire reinforcing bars.

horizontal alignment with plumb bobs, laser equipment, transits, or levels; and then bolt or weld the piece permanently in place.

Reinforcing metal workers set the bars in the forms that hold concrete, following blueprints showing the location, size, and number of reinforcing bars. They then fasten the bars together by tying wire around them with pliers. When reinforcing floors, workers place blocks under the reinforcing bars to hold the bars off the deck. Although these materials usually arrive ready to use, metal workers occasionally must cut bars with metal shears or acetylene torches, bend them by hand or machine, or weld them with arc-welding equipment. Some concrete is reinforced with welded wire fabric. Using hooked rods, workers cut and fit the fabric and, while a concrete crew places the concrete, metal workers properly position the fabric in the concrete.

Workers install ornamental ironwork and related pieces after the exterior of the building has been completed. As they hoist pieces into position, metal workers bring them into position, make sure they fit correctly and bolt, braze, or weld them for a secure fit.

Metal fabricators fabricate and assemble structural metal products, such as metal tanks used to store petroleum, water, or other fluids and assemble metal parts for bridges and prefabricated metal buildings, according to plans or specifications.

Working Conditions

Structural and reinforcing metal workers usually work outside in all kinds of weather. However, those who work at great heights do not work when it is wet, icy, or extremely windy. Because the danger of injuries due to falls is great, ironworkers use safety devices, such as safety belts, scaffolding, and nets to reduce risk.

Employment

Structural and reinforcing metal workers held about 87,000 jobs in the construction industry in 1998. About 1 out of every 2 worked for structural steel erection contractors. Most of the remainder worked for contractors specializing in the construction of homes; factories; commercial buildings; churches; schools; bridges and tunnels; and water, sewer, communications, and power lines.

Structural and reinforcing metal workers are employed in all parts of the country, but most work in metropolitan areas, where most commercial and industrial construction takes place.

Training, Other Qualifications, and Advancement

Most employers recommend apprenticeship as the best way to learn this trade. The apprenticeship consists of 3 or 4 years of on-the-job training and a minimum of 144 hours a year of classroom instruction. Apprenticeship programs are usually administered by joint union-management committees made up of representatives of local unions of the International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers and local chapters of contractors' associations.

Metal workers must be at least 18 years old. A high school diploma may be preferred by employers and may be required by some local apprenticeship committees. High school courses in general mathematics, mechanical drawing, and shop are helpful. Because materials used in metal working are heavy and bulky, metal workers must be in good physical condition. They also need good agility, balance, eyesight, and depth perception to safely work at great heights on narrow beams and girders. Metal workers should not be afraid of heights or suffer from dizziness.

In the classroom, apprentices study blueprint reading; mathematics for layout work; the basics of structural erecting, rigging, reinforcing, welding and burning; ornamental erection; and assembling. Apprentices also study the care and safe use of tools and materials. On the job, apprentices work in all aspects of the trade, such as unloading and storing materials at the job site, rigging materials for movement by crane or derrick, connecting structural steel, and welding.

Some metal workers learn the trade informally on the job without completing an apprenticeship. These workers generally do not receive classroom training, although some large contractors have extensive training programs. On-the-job trainees usually begin by assisting experienced ironworkers by doing simple jobs, like carrying various materials. With experience, trainees perform more difficult tasks like cutting and fitting different parts. Learning through work experience alone may not provide training as complete as an apprenticeship program, however, and usually takes longer.

Some experienced workers become supervisors. Others may go into the contracting business for themselves.

Job Outlook

Employment of structural and reinforcing metal workers is expected to increase more slowly than the average for all occupations through the year 2008, largely because of the continued slow growth in industrial and commercial construction. The rehabilitation and maintenance of an increasing number of older buildings, factories, power plants, and highways and bridges is expected to increase, mitigating somewhat slower employment growth. In addition, more metal workers will be needed to build incinerators and other structures to contain hazardous materials as part of ongoing toxic waste cleanup. Although employment growth will create many new jobs for structural and reinforcing metal workers, most openings will result from the need to replace experienced metal workers who transfer to other occupations or leave the labor force.

The number of job openings fluctuates from year to year as economic conditions and the level of construction activity change. During economic downturns, metal workers can experience high rates of unemployment. Similarly, job opportunities for metal workers may vary widely by geographic area. Job openings for metal workers usually are more abundant during the spring and summer months, when the level of construction activity increases.

Earnings

In 1998, median hourly earnings of structural and reinforcing metal workers in all industries were $15.81. The middle 50 percent earned between $11.66 and $21.94. The lowest 10 percent earned less than $9.17 and the highest 10 percent earned more than $26.64. Median hourly earnings in the industries employing the largest number of structural and reinforcing metal workers in 1997 were:

Miscellaneous special trade contractors	$16.50
Nonresidential building construction	12.40

In 1997, median hourly earnings of metal fabricators of structural metal products working for miscellaneous special trade contractors were about $13.00.

Many workers in this trade are members of the International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers. According to the limited information available, average hourly earnings—including benefits—for structural and reinforcing metal workers who belonged to a union and worked full time, ranged between $14.90 and $48.30 in 1998. Structural and reinforcing metal workers in New York, Boston, San Francisco, Chicago, Los Angeles, Philadelphia, and other large cities received the highest wages.

Apprentices generally start at about 50 to 60 percent of the rate paid to experienced journey workers. They receive periodic increases throughout the course of the apprenticeship program, as they acquire the skills of the trade, until their pay approaches that of experienced workers.

Earnings for metal workers may be reduced on occasion because work can be limited by bad weather, the short-term nature of construction jobs, and economic downturns.

Related Occupations

Structural and reinforcing metal workers play an essential role in erecting buildings, bridges, highways, powerlines, and other structures. Others who also work on these construction jobs are operating engineers, cement masons and concrete finishers, and welders.

Sources of Additional Information

For more information on apprenticeships or other work opportunities, contact local general contractors; a local of the International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers Union; a local joint ironworkers' union-management apprenticeship committee; a local or State chapter of the Associated Builders and Contractors, or the nearest office of your State employment service or apprenticeship agency.

For general information about metalworkers, contact:

☛ Associated General Contractors of America, Inc., 1957 E St. NW., Washington, DC 20006.

☛ International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers, 1750 New York Ave. NW., Suite 400, Washington, DC 20006.

☛ National Erectors Association, 1501 Lee Hwy., Suite 202, Arlington, VA 22209.

☛ National Association of Reinforcing Steel Contractors, 10382 Main St., Suite 300, P.O. Box 280, Fairfax, VA 22030.